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VERIFICATION OF TRANSLATION

I, Dr. Monica Koch, of Alte Allee 47, 81245 Munich, Germany, am the translator of the documents attached and I state that the following is a complete and accurate translation to the best of my knowledge and belief of the German Patent Application entitled "Verfahren für die Bearbeitung von Blattgut," filed by Giesecke & Devrient GmbH.

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Method for processing sheet material

The present invention relates to a method for processing sheet material, in particular papers of value such as bank notes, checks, etc., by which different groups of sheet material are processed successively, the different groups of sheet material being separated for processing.

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A method and bank note processing machine for processing different groups of bank notes are known for example from JP 62-82493 A. The different groups of bank notes correspond to deposits by different depositors which are separated by separator cards. The separator cards are inserted between the different deposits to separate them. The separator cards may be disposed at the beginning, the end or the beginning and end of the group of bank notes forming the particular deposit. The separator cards may contain information for example about the depositor and/or the deposit. Further, the separator cards are designed so as to be recognized automatically by the bank note processing machine during processing. When a separator card is recognized the bank note processing machine can enter in the books the associated group of bank notes for the corresponding deposit or depositor. For recognizing the separator cards the bank note processing machine has magnetic sensors which, on the one hand, are used for reading the information coded on a magnetic stripe on the separator cards. On the other hand, the signals of the sensors can be used to recognize the separator cards even when the latter are masked by bank notes, as may occur upon multiple removal for example. Thus it is ensured with relatively high probability that the separator cards are always recognized, so that at least the boundaries between individual deposits can be recognized.

A similar method for semicontinuous processing of bank notes is known from WO 98/05006 A1.

However, known methods have the disadvantage that the preparation, i.e. separation by an operator using separator cards, is error-prone, in particular when the operator must provide each separator card with information about the associated deposit, because this frequently involves transfer errors and mix-ups. In addition, when the magnetic stripe of the separator card is masked it is frequently impossible to read

the coded information contained therein, which prevents recognition of the individual groups of sheet material.

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The problem of the present invention is therefore to state a method for processing sheet material, in particular papers of value such as bank notes, checks, etc., by which different groups of sheet material are processed successively, the different groups of sheet material being separated for processing, which allows a processing of the different groups of sheet material which is improved both with respect to recognition of the different groups of sheet material by the bank note processing machine and with respect to the proneness to error during preparation by an operator. In addition, means should be stated for carrying out the method.

2 ~~This problem is solved according to the invention by the features of claims 1 and 7.~~

The invention starts out from the consideration that at least one information means is used besides a strict separating means for separating and processing each group of sheet material. The separating means thus serves only to separate the individual groups of sheet material from each other, whereas the information means is used for providing information about the particular group of sheet material for processing.

The advantage of the invention is in particular that the proposed division into a separating means and at least one information means facilitates the processing of different groups of sheet material because the information means can already be added to the particular group of sheet material before actual processing on the bank note processing machine. This means that the information identifying the particular group of sheet material can be transferred to the information means when the particular group of sheet material is being formed. Thus, no mix-ups, false associations or transfer errors upon later association of the information can occur. Further, processing by the bank note processing machine is improved because if the separating means is not recognized the faulty processing is recognized upon recognition of the following information means. Conversely, nonrecognition of the information means can accordingly be recognized when the separating means is recognized. If a plurality of information means are used for identifying a group of sheet material, the de-

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scribed possibilities of analysis for recognizing faulty processing are improved, for example as it is then possible to form subgroups. Furthermore, the use of a plurality of information means attains a redundancy for the information or parts of the information which contributes to increasing the avoidance of recognition errors.

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Further advantages of the present invention will result from the dependent claims and the following description of examples with reference to figures, in which:

Figure 1 shows a basic structure of a bank note processing machine for processing different groups of sheet material,

Figure 2 shows a first arrangement of a group of sheet material with affiliated separating means and information means,

Figure 3 shows a second arrangement of a group of sheet material with affiliated separating means and information means,

Figure 4 shows a third arrangement of a group of sheet material with affiliated separating means and information means,

Figure 5 shows a first embodiment of a bank note processing machine which does not alter the order of the sheet material during processing, and

Figure 6 shows a second embodiment of a bank note processing machine which does not alter the order of the sheet material during processing.

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The processing of different groups of sheet material will be described in the following by way of example with reference to the processing of different groups of bank notes, to be referred to in the following as deposits. The different deposits are separated from each other by separating means, for example separator cards. Additionally the different deposits each contain at least one information means, for example information cards. For processing the different deposits a bank note processing machine is used.

Figure 1 shows a basic structure of bank note processing machine 100 for processing different groups of bank notes or deposits. Bank note processing machine 100 has input unit 110 in which the different deposits are inserted. Connected to input unit 110 is singler 111 which removes single bank notes of the different deposits and the separator cards and information cards from input unit 110 and delivers them to transport system 120. Transport system 120 transports the single bank notes as

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well as separator cards and information cards through sensor device 112 which determines data from the bank notes to indicate for example authenticity, state, denomination, etc. Furthermore, in sensor device 112 the separator cards are recognized and information contained on the information card is detected by sensor device 112. The determined data of the bank notes, the presence of separator cards and the detected information of the information cards are transmitted to control device 140 which evaluates the data, the presence of separator cards and the information in order to control the further flow of bank notes or separator cards and information cards through bank note processing machine 100. For this purpose control device 140 acts on switches 121 to 124 which are part of transport system 120 and allow the bank notes or separator cards and information cards to be deposited in output units 130 to 139 according to given criteria. Output units 130 to 139 can be formed for example as spiral pocket stackers which stack the bank notes or separator cards and information cards to be deposited in bins 131, 133, 135, 137, 139 by means of rotating units 130, 132, 134, 136, 138 having spiral pockets. Separator cards and information cards are deposited in special output unit 130, 131 in which for example nonrecognized or faulty bank notes are also deposited.

The separator cards are used, as mentioned above, for recognizing the boundaries of different deposits during automatic bank note processing. Additionally, the separator cards can be used for mutually delimiting rejected bank notes, i.e. bank notes classified as false or faulty when checked by sensor device 112 and control device 140.

The separator cards are documents which can be singled, transported and stacked like bank notes in bank note processing machine 100. They are designed so as to be clearly distinguished from bank notes and can therefore be recognized by bank note processing machine 100. The separator cards differ from the bank notes to be processed in physical properties, such as size, shape and thickness, in their print, through color and pattern or other features, e.g. physical properties such as magnetic, electroconductive or fluorescent areas.

The properties of the separator cards, e.g. caused by conductive elements, allow reliable recognition of the separator cards since the conductive elements can be

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detected reliably even in the case of multiple removal, i.e. when a plurality of bank notes or bank notes and separator cards instead of one bank note or separator card are grasped by singler 111, causing the separator cards to be masked. It is of special advantage if these patterns differ so clearly from conductive elements on bank notes (e.g. security thread or other applied conductive security elements) that the presence of a separator card is not erroneously indicated or a present separator card missed even in the case of multiple removal with partially overlapping bank notes. One way to do this is to apply a plurality of conductive bars to the separator card and design evaluation so that separator card recognition takes place only if at least three or four of said bars are present.

Use of conductive patterns is advantageous over known methods, e.g. based on magnetic bars, in that conductivity is largely independent of the distance from the detecting measuring system and thus involves higher reliability. A further advantage is that conductivity is also detectable at a standstill or very slow run of the transport system, while magnetic evaluation involves a dependence of signal strength on transport speed. Such conductive elements can be detected for example by sensors which feed in a high-frequency electric field at one point and have a receiver for high-frequency fields at another point. When a conductive transmission path is present there is capacity coupling between transmitter and receiver and thus a reliable detection.

Further possibilities for reliable recognition of a separator card are applied inductive elements or antenna coils. The latter can be wound in the form of a flat coil by a conventional method or be printed as a coil with the aid of conductive ink. Detection can be effected for example by feeding in a high-frequency electric field and by the interaction of said coil in the form of an influence on the frequency of a resonant circuit formed with the transmitter elements.

Further possibilities for reliable recognition of a separator card are given by forming certain physical properties. The latter can be realized for example by a special stiffness of the carrier material to be detected by a force measurement on a deflection or in another way. Other recognition methods can be based on a special design e.g. in the behavior of reflecting sound, the production of special soundwaves

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during bank note transport or special behavior when subjected to electromagnetic waves. One can likewise evaluate optical properties such as fluorescence.

The separator cards are inserted during preparation between the groups of bank notes of the different deposits which are to be separately tested and accounted. The separator cards can be used as lead cards, i.e. at the beginning of a deposit, or trailing cards, i.e. at the end of a deposit, or also in combination of said two variants. The same applies to the information cards.

During preparation of the individual deposits, i.e. by the depositor or upon insertion of the separator cards by an operator of bank note processing machine 100, the data of the deposits are collected and transferred to the information cards. The deposit data may be present for example in the form of an accompanying slip (delivery note). Said data may be applied by hand or printed in machine-readable fashion, or they may be already known because the depositor has reported the data of the deposit by telephone (telebanking) or in another way. The data association is produced on the information card e.g. by means of a unique mark, e.g. a bar code. In a further case of application it may be that the value of the deposit is unknown and to be ascertained only during bank note processing.

In order for the depositor to provide the deposit data for processing with bank note processing machine 100 there are a number of possibilities.

A first approach is for the depositor to produce a document to be used as an information card. This may be done using special programs permitting the depositor to collect and enter in the books the data of his deposit, the program automatically executing a data transfer with the collected data to the service provider, e.g. via the Internet or other telecommunication channels, and an accompanying slip being printed out at the depositor's end which is enclosed in the deposit and can be used directly as a machine-readable information card during bank note processing.

With reference to the structure of groups of sheet material or deposits shown in Figures 2 to 4 the function of the abovementioned separating means and the information means shall be described in more detail. Obviously, the structure of groups of sheet material shown in Figures 2 to 4 is exemplary. Any other structure is possible, in particular more bank notes can be present than shown in the examples.

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Figure 2 shows a first deposit consisting of separating means *TK1*, bank notes *BN1* to *BN6* and one information means *IK1* located between bank notes *BN2* and *BN3*.

Figure 3 shows a second deposit consisting of separating means *TK2*, bank notes *BN7* to *BN12* and two information means *IK2* and *IK3*.

Figure 4 shows a third deposit consisting of separating means *TK4*, bank notes *BN13* to *BN15* and one information means *IK4*. Information means *IK4* is followed by a further deposit shown by separating means *TK5* and a dotted line in Figure 4.

Separating means *TK1* to *TK5* can be formed as separator cards, as shown in Figures 2 to 4. Separating means *TK1* to *TK5* are recognized by sensor device 112 with reference to specific properties, as described.

Information means *IK1* to *IK4* formed as information cards bear information, as described above. Separating means *TK1* to *TK5* serve only to separate the different deposits, whereas information cards *IK1* to *IK4* are used to provide the information required for processing. Information cards *IK1* to *IK4* may be of simple design, in particular they lack the special properties of separating means *TK1* to *TK5*. This permits corresponding information means *IK1* to *IK4* to be already prepared and provided with the desired information by the depositor making the particular deposit.

During later processing of the different deposits with bank note processing machine 100 an operator then merely inserts separator cards *TK1* to *TK5* between the individual deposits. Separator cards *TK1* to *TK5* can also be already inserted by the depositor. In the simplest case, information cards *IK1* to *IK4* can also be formed by part of the sheet material itself, for example the serial number of a bank note can be used for unique identification so that the bank note forms the information card. The corresponding data, such as depositor, deposited amount, etc., are then associated with the serial number in control unit 140 of bank note processing machine 100 for processing.

As shown in Figures 2 to 4, information cards *IK1* to *IK4* can be disposed at any points within the particular deposit, after particular separator card *TK1* to *TK4*.

In the first deposit in Figure 2, information card *IK1* is located for example after separator card *TK1* and bank notes *BN1* and *BN2*.

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In the second deposit in Figure 3, information card *IK2* is located directly after separator card *TK2* and further information card *IK3* between bank notes *BN9* and *BN10*. By using two information cards *IK2* and *IK3* within the second deposit one can thus also form subgroups of bank notes *BN7* to *BN9* and *BN10* to *BN12*. In the same way one can form further subgroups by using further information cards. Said subgroups can correspond for example to individual cash registers of a supermarket which together form the supermarket's deposit.

The third deposit in Figure 4 begins with separator card *TK4* which is followed by bank notes *BN13* to *BN15* to be processed. The end of the third deposit is formed by information card *IK4*. Directly after information card *IK4* comes separator card *TK5* of the next deposit. The structure of the third deposit has the advantage that the processing of bank notes *BN13* to *BN15* can be performed especially reliably because the given order (separator card *TK4* - bank notes *BN13* to *BN15* - information card *IK4*) ensures that errors, as caused e.g. by multiple removals and resulting permutations in the order, can be recognized. After recognition of separator card *TK4*, bank notes *BN13* to *BN15* must follow first, then information card *IK4*. After that, either the processing operation must be over - if no further deposits follow - or separating means *TK5* of the next deposit must directly follow. Any ascertained deviation from this order, in particular bank notes between information means *IK4* and separating means *TK5*, indicates that an error has occurred in processing, which can be remedied by taking the measures explained below.

During processing of the deposits in bank note processing machine 100 the separator cards are distinguished from the bank notes and recognized due to their special features by sensor device 112 of bank note processing machine 100. Special features, e.g. magnetic or electroconductive stripes, and special evaluation methods coordinated therewith in sensor device 112 ensure that a separator card is reliably recognized even in the case of a multiple removal with double-sided masking by bank notes. The information on the information cards is likewise read by sensor device 112.

The presence of a further separator card indicates the end of processing of a first deposit and the beginning of a second deposit. The data of the stacked bank

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notes for the first deposit and the information on the affiliated information card are stored for later evaluation in control unit 140. The separator card and the affiliated information card are stacked in special output unit 130, 131 and separate the rejected bank notes of the first deposit from the rejected bank notes of the second deposit for later reworking, which can be done for example at a separate workplace.

When the end of a bank note stack with a plurality of deposits is reached the bank notes and the separator cards and information cards are removed from special output unit 130, 131 and manual reworking performed. This can be done on the bank note processing machine or at a separate workplace. The information on the information cards can be detected for example by means of a bar code reader. The worker removes the particular bank notes affiliated with an information card, assesses the bank notes according to their denomination and authenticity and enters these data. As soon as the worker has finished entering a deposit, the deposit value ascertained on the machine and that ascertained during manual reworking can be added up and compared with the set value entered during preparation and any deviation ascertained and logged.

To simplify manual reworking it is expedient to reduce the number of bank notes to be processed as far as possible. One possible solution is to feed the bank notes and separator cards stacked in special output unit 130, 131 and information cards to singler 111 and process them by machine again in a rerun. Experience has shown that more than half of the bank notes rejected in the first run are then recognized as authentic and stacked and accounted accordingly. This method requires that the order of separator cards, information cards and bank notes is not altered by singling, bank note transport or deposit, not even in the case of multiple removal. This can be attained by a special geometric design of transport system 120 and is dependent on singler 111 used.

Figures 5 and 6 show possible embodiments of transport system 120. Singler 111 shown in Figure 5 which singles deposit 70 beginning with uppermost bank note A requires a reversal in transport system 120. The order of deposit 70' resulting in output unit 130 then corresponds to the original order of deposit 70. Before new singling, however, the stack of deposit 70' must be rotated by 180°. For singler 111

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shown in Figure 6 which singles deposit 80 beginning with lowermost bank note *D* the initial order of deposit 80 results automatically in output unit 130 for deposit 80' stacked there.

It is also possible to perform several reruns in order to further reduce the number of documents remaining for manual reworking. Control unit 140 of bank note processing machine 100 adds up the results of the stacked bank notes of all runs for each deposit so that the repeated processing is not to be taken into account for the following processing steps and calculations.

In following steps for completing the accounting, the depositor receives a credit entry of the deposit value, a confirmation of the credit entry for the deposit or a correction of the credit entry with a deviation report for the deposit. Depending on the design of the system, this information can also be provided electronically, by fax or by sending a notice.

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